The present invention resides in a connecting material for bonding and connecting a semiconductor chip with a substrate glass board in a COG assembly, in which an improved tensile elongation percentage of the connecting material is attained by incorporating in the adhesive component a microparticulate elastomer of natural or synthetic rubber. By the incorporation of the microparticulate elastomer, a reduction of stress concentration at the interface between the connecting material and the glass substrate is attained, even if a higher adhesion strength of the connecting material is required. Thus, deformation of the glass substrate, such as warping etc., can be reduced, even when a thin substrate glass board is used, together with attainment of superior adhesion strength and secured electric connection.

Essential features of the invention not only reside in the definite glass transition temperature and the definite elastic modulus but also, as the most important feature, a definite tensile elongation. According to the present invention, a definite content of a microparticulate elastomer is designated in order to improve the tensile elongation.

According to the present invention, the tensile elongation percentage of the cured connecting material can be improved by the inclusion of a microparticulate elastomer product of natural or synthetic rubber having a rubbery elasticity in which the rubber skeleton of the elastomer product has a molecular structure permitting elastomeric expansion/contraction so that a tensile elongation of the connecting material, after having been cured, of at least 5% is attained.

It is respectfully submitted that the presently claimed invention is patentable distinguishable over the prior art cited by the Examiner.

The Tomita et al reference discloses a circuit connecting material and structure and method of connecting circuit terminals. While Tomita discloses in paragraph [0071] an

adhesive component comprising elastomer microparticles, the microparticles of Tomita are constituted of an elastomer-modified phenoxy resin product in which an elastomer is bonded chemically to the phenoxy resin by a partial esterification (See paragraph 0068). This elastomer-modified product has a phenoxy resin/elastomer proportion of 66/33 to 87/13 (See paragraph 0065) and is a resin composed mainly of a phenoxy resin. Thus, the elastomer of Tomita is present in a form, in which elastomer molecules are bonded as side chains to the phenoxy resin skeleton, which is different from the structure of the microparticulate elastomer according to the present invention in which isolate microparticles of the elastomer of natural rubber or synthetic rubber is dispersed in the thermosetting resin. In contrast thereto, the adhesive component of the connecting material of Tomita is constituted of a phenoxy resin skeleton having a molecular structure of rather rigid and permitting scarce expansion/contraction, to which the elastomer molecules are bonded as side chains, so that the elastomer of Tomita will not provide any improvement of tensile elongation and, with such a molecular structure, any improvement in tensile elongation as required in the present invention would not be attainable. Therefore, Tomita does not anticipate the connecting material according to the present invention.

Although Tomita discloses in paragraph 0071 a microparticulate elastomer, the elastomer of Tomita consists of an elastomer-modified phenoxy resin having a phenoxy main chain and elastomer side chains, in which the compatibility of the phenoxy chain with the elastomer chain is low and they are in a repulsive interaction, thus causing phase separation to form the microparticulate structure. This is considered as the phenomena observed under a microscope or the like in the case where the elastomer-modified phenoxy resin is present isolately. It is considered, however, such a phase-separated submicroscopic particulate state is not maintained, when it is

used as a component of an adhesive together with a radical-polymerizable resin and others in a mixture. Therefore, Tomita does not disclose the microparticulate elastomer adhesive component made of natural or synthetic rubber and the connecting material of Tomita would not improve the tensile elongation of the adhesive component as in the present invention.

The Yamada reference has been cited by the Examiner as disclosing a COG assembly which is a liquid crystal display. However, there is no disclosure in Yamada which would motivate one of ordinary skill in the art to modify the primary Tomita reference in a manner that would yield the presently claimed invention. As such, it is respectfully submitted that the presently claimed invention is clearly patentable over Yamada et al and Tomita, either singly or in combination.

Reconsideration of the present application and the passing of it to issue is respectfully solicited.

Respectfully submitted,

TFC/smd

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Encl: Marked-Up Amended Claims 8 and 9
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8. (~~New~~Amended) A connecting material for bonding and connecting a semiconductor chip with a substrate glass board and forming a COG assembly in which electrodes provided on the semiconductor chip are held in direct connection with corresponding electrodes provided on the substrate glass board, said connecting material having a tensile elongation percentage at 25°C of at least 5%, after being cured, and comprising:

an adhesive component comprising a thermosetting resin and 6-90 wt.% of a microparticulate elastomer product of natural or synthetic rubber having an average particle size of 30-300 nm and

electroconductive particles.

9. (~~New~~Amended) A COG assembly comprising a semiconductor chip having electrodes provided thereon and a substrate glass board having electrodes provided thereon corresponding to the electrodes provided on the semiconductor chip, the electrodes provided on the semiconductor chip being held in direct connection with the corresponding electrodes provided on the substrate glass board by a connecting material, the connecting material having a tensile elongation percentage of at least 5% at 25°C, after being cured, and comprising an adhesive component comprising a thermosetting resin and 6-90 wt.% of a microparticulate elastomer product of natural or synthetic rubber having an average particle size of 30-300 nm and electroconductive particles.